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**Pre-AP Biology: Unit 2, DBA #4 Review**

***Practice Questions:*** *Answer the following questions thoroughly and accurately in preparation for your Daily Biology Assessment.*

1. An enzyme is a specific type of which macromolecule?

A protein

2. Explain why an enzyme and substrate are often thought of as a lock and key. Use the term “active site” in your response.

A substrate fits into an enzyme’s active site like a lock fits into a key. There has to be a very specific fit between the substrate and active site for the enzyme to assist with the reaction in which substrates are converted to products.

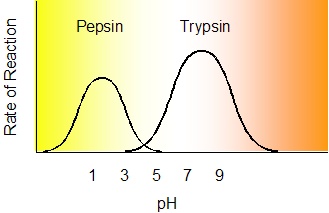
So… the substrate is the key, the enzyme is the lock, and the active site is the keyhole on the lock.

3. Why is the rate of an enzyme-assisted reaction slower at lower temperatures?

Molecules including enzymes and substrates move around more slowly at low temperatures. If substrates and enzymes are moving more slowly, they “bump into” each other less frequently. This means that substrates do not fit into enzymes’ active sites as frequently, which results in a lower rate of reaction. In other words, the reaction progresses more slowly (less product formed over time).

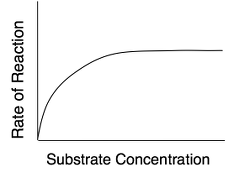
4. Why is the rate of an enzyme-assisted reaction slower at extremely high temperatures?

At extremely high temperatures, an enzyme denatures. This means it loses its unique shape and is unable to bind to its substrate(s) to assist with the reaction. If the enzyme cannot assist with the reaction, the reaction takes place much more slowly (or not at all).



5. Explain how the graph given to the right provides support for the following statement: “Each enzyme functions best at a different optimal pH.”

Pepsin has its highest rate of reaction around a pH of 1 or 2. As such, its optimal pH is around 1 or 2. Trypsin has the highest rate of reaction around a pH of 8. As such, its optimal pH is around 8. Above or below these optimal pH values, pepsin and trypsin denature, and the rate of reaction drops significantly.

6. Explain why the rate of reaction eventually plateaus (aka stabilizes) in the graph to the right.

Initially, as the substrate concentration increases, the rate of reaction increases as well. If there are more substrate molecules for the enzymes to act upon, there will be more product molecules formed.

The rate of reaction eventually levels off as the substrate concentration continues to increase because all the enzymes have substrates in their active sites. At this point, we say that the enzymes are “saturated” with substrate molecules. Adding more substrate molecules will not increase the rate of reaction because they have no more enzymes to bind to. As such, the only way to increase the rate of reaction at this point is to add more enzyme molecules.

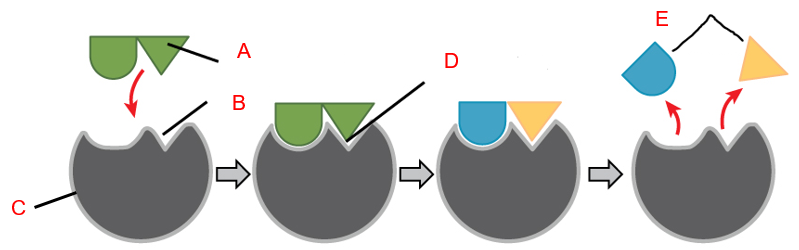
7. What are two ways in which you could measure the rate of reaction?

You could measure the amount of substrate molecules present. This number should decrease over time as substrates are converted to products.

You could also measure the amount of product molecules present. This number should increase over time as substrates are converted to products.

You cannot measure the amount of enzyme molecules present to determine the rate of reaction. This number should stay constant because enzymes are unchanged by the reaction and can be used over and over again to convert substrates to products.

8. Label the enzyme, products, substrate, enzyme-substrate complex, and active site on the picture given below.



A = substrate

B = active site

C = enzyme

D = enzyme-substrate complex

E = products

9. Define activation energy. Describe how the activation energy of a reaction is changed in the presence of an enzyme (see graphs below).

Activation energy (also known as the energy of activation) is defined as the energy required to start a reaction in which reactants are converted to products. In the graph below and to the left, there is no enzyme present to assist with the reaction, and the activation energy is very high. In the graph below and to the right, there is an enzyme present to assist with the reaction. This enzyme lowers the activation energy of the reaction and results in the reaction proceeding more quickly (i.e. more product molecules formed over a given amount of time).

